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ABSTRACT

This learning activity packet (LAP) outlines the study activities and performance tasks covered in a related curriculum guide on milling machines. The course of study in this LAP is intended to help students learn to set up and operate a horizontal mill. Tasks addressed in the LAP include mounting style "A" or "B" arbors and adjusting arbor support bushings, using machine controls properly, mounting a cutter to an arbor, mounting and aligning a swivel-base vise, aligning work mounted to a table, aligning angle plates at right angles to columns, mill squaring a workpiece mounted in a vise, performing face milling operations using a style "C" arbor, milling a keyway with a staggered-tooth mill cutter, performing a straddle milling operation, milling an angle with a single-angle mill cutter, and milling to blueprint specifications using machine controls. Included in the LAP are unit and specific objectives, a pretest, information and assignment sheets, cross-references to the curriculum guide, job sheets, and answers to the pretest and the assignment sheets. Page numbers in the LAP are coordinated with those in the curriculum guide. (MN)

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State Department of Vocational and Technical Education CIMC Stillwater, Oklahoma LEARNING ACTIVITY PACKETS

for MILLING MACHINES

LAP NO. _____ CODE: _____

INSTRUCTIONAL UNIT UNIT II--HORIZONTAL MILLING MACHINES

LEARNING ACTIVITY PACKET NO.	PREREQUISITE LAP(S)
2	1

PURPOSE: This Learning Activity Packet (LAP) outlines the study activities and performance tasks for "Horizontal Milling Machines." Accomplishing these procedures will aid the student in attaining a working knowledge of this area of training and in achieving a Skilled or Moderately Skilled competency level in the performance of jobs associated with this specialty.

INTRODUCTION: The course of study in this LAP will help the student become able to set up and operate a horizontal mill.

TASKS INCLUDED IN THIS LAP:

1. Mount a style "A" or "B" arbor and adjust arbor support bushing.
2. Use machine controls properly.
3. Mount cutter to arbor.
4. Mount and align swivel-base vise.
5. Align work mounted to table.
6. Align angle plate at right angle to column.
7. Mill square a workpiece mounted in vise.
8. Perform face milling operation using style "C" arbor.
9. Mill a keyway with staggered-tooth mill cutter.
10. Perform a straddle milling operation.
11. Mill an angle with single-angle mill cutter.
12. Mill to blueprint specifications using machine controls.

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User of LAP:

Included in this LAP are the answers to the pre-test and answers to the assignment sheets. If you desire to evaluate these two components, then it will be your responsibility to remove these components from the LAP prior to giving to the student. If you desire for the student to assume the responsibility for self-evaluation, then we would suggest that you leave the components contained as part of the LAP.

We hope this developmental design proves to be beneficial to you.

Sincerely,

Bob Patton, Coordinator
Curriculum and Instructional
Materials Center

BP:jd

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82-000704

MILLING MACHINES
UNIT II--HORIZONTAL MILLING MACHINES

LEARNING STEPS

Check the following blanks as you complete the required steps.

_____	1. Read	Unit and Specific Objectives, page MM-145.
_____	2. Complete	Horizontal Milling Machines Pretest, LAP page 15.
_____	3. Study	The sections of the Information Sheet, pages MM-149 through 154, indicated by your instructor on your Pretest.
_____	4. Refer	To Step 3 of your Pretest. If additional study is indicated for Information Sheet, Section I, continue to Learning Step 5. Otherwise, proceed to Learning Step 7.
_____	5. Do	LAP Assignment Sheet #1, LAP page 19.
_____	6. Do	LAP Assignment Sheet #2, LAP page 21.
_____	7. Refer	To Step 3 of your Pretest. If additional study is indicated for Information Sheet, Section II, continue to Learning Step 8. Otherwise, proceed to Learning Step 11.
_____	8. Do	Assignment Sheet #1--List Horizontal Milling Operations Required to Make Parts, pages MM-155 and 156.
_____	9. Stop.	Have your instructor evaluate your Assignment Sheet. If your instructor is satisfied with your performance, proceed to Learning Step 11. Otherwise, continue to Learning Step 10.

LEARNING STEPS

_____ 10. Do LAP Assignment Sheet #3, LAP page 23.

_____ 11. Check The following tasks that you think you can perform without supervision.

Student Check		Instructor Initials/Date: Skilled	Moderately Skilled
_____	a. Mount a style "A" or "B" arbor and adjust arbor support bushing (14)	_____	_____
_____	b. Use machine controls properly (20)	_____	_____
_____	c. Mount cutter to arbor (26)	_____	_____
_____	d. Mount and align swivel-base vise (32)	_____	_____
_____	e. Align work mounted to table	_____	_____
_____	f. Align angle plate at right angle to column (44)	_____	_____
_____	g. Mill square a workpiece mounted in vise (50)	_____	_____
_____	h. Perform face milling operation using style "C" arbor (56)	_____	_____
_____	i. Mill a keyway with staggered-tooth mill cutter (62)	_____	_____
_____	j. Perform a straddle milling operation (68)	_____	_____
_____	k. Mill an angle with single-angle mill cutter (74)	_____	_____
_____	l. Mill to blueprint specifications using machine controls (80)	_____	_____

LEARNING STEPS

____ 12. Discuss	Your competency in each task with your instructor. Your instructor will initial each task in which you demonstrate sufficient competency. If all tasks have been initialed by your instructor, proceed to Learning Step 86. Otherwise, continue to Learning Step 13.
____ 13. Refer	To Learning Step 11a. If this task has been initialed by your instructor, proceed to Learning Step 19. Otherwise, continue to Learning Step 14.
____ 14. Study	Job Sheet #1--Mount a Style "A" or "B" Arbor and Adjust Arbor Support Bushing, pages MM-159 through MM-163.
____ 15. Watch	Slide/tape presentation, "Mount a Style "A" or "B" Arbor and Adjust Arbor Support Bushing" (MM-II-1).
____ 16. Do	Job Sheet #1--Mount a Style "A" or "B" Arbor and Adjust Arbor Support Bushing.
____ 17. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, proceed to Learning Step 19. Otherwise, repeat Learning Steps 14 through 16 and then continue to Learning Step 18.
____ 18. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11a, and continue to Learning Step 19. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instuctor initial Learning Step 11a, and continue to Learning Step 19.

LEARNING STEPS

_____	19. Refer	To Learning Step 11b. If this task has been initialed by your instructor, proceed to Learning Step 25. Otherwise, continue to Learning Step 20.
_____	20. Study	Job Sheet #2--Use Machine Controls Properly, pages MM-165 through 168.
_____	21. Watch	Slide/tape presentation, "Use Machine Controls Properly" (MM-II-2).
_____	22. Do	Job Sheet #2--Use Machine Controls Properly.
_____	23. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11b, and proceed to Learning Step 25. Otherwise, repeat Learning Steps 20 through 22 and then continue to Learning Step 24.
_____	24. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11b, and continue to Learning Step 25. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11b, and continue to Learning Step 25.
_____	25. Refer	To Learning Step 11c. If this task has been initialed by your instructor, proceed to Learning Step 31. Otherwise, continue to Learning Step 26.
_____	26. Study	Job Sheet #3--Mount Cutter to Arbor, pages MM-169 through MM-171.
_____	27. Watch	Slide/tape presentation, "Mount Cutter to Arbor" (MM-II-3).

LEARNING STEPS

_____	28. Do	Job Sheet #3--Mount Cutter to Arbor.
_____	29. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11c, and proceed to Learning Step 31. Otherwise, repeat Learning Steps 26 through 28 and then continue to Learning Step 30.
_____	30. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11c, and continue to Step 31. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11c, and continue to Learning Step 31.
_____	31. Refer	To Learning Step 11d. If this task has been initialed by your instructor, proceed to Learning Step 37. Otherwise, continue to Learning Step 32.
_____	32. Study	Job Sheet #4--Mount and Align Swivel-Base Vise, pages MM-173 through MM-177.
_____	33. Watch	Slide/tape presentation, "Mount and Align Swivel-Base Vise" (MM-II-4).
_____	34. Do	Job Sheet #4--Mount and Align Swivel-Base Vise.
_____	35. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11d, and proceed to Learning Step 37. Otherwise, repeat Learning Steps 32 through 34 and then continue to Learning Step 36.

____ 36.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11d, and continue to Learning Step 37. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11d, and continue to Learning Step 37.
____ 37.	Refer	To Learning Step 11e. If this task as been initialed by your instructor, proceed to Learning Step 43. Otherwise, continue to Learning Step 38.
____ 38.	Study	Job Sheet #5--Align Work Mounted to Table, pages MM-179 through 182.
____ 39.	Watch	Slide/tape presentation, "Align Work Mounted to Table" (MM-II-5).
____ 40.	Do	Job Sheet #5--Align Work Mounted to Table.
____ 41.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11e, and proceed to Learning Step 43. Otherwise, repeat Learning Steps 38 through 40 and then continue to Learning Step 42.
____ 42.	Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11e, and proceed to Learning Step 43. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11e, and continue to Learning Step 43.

____ 43. Refer	To Learning Step 11f. If this task has been initialed by your instructor, proceed to Learning Step 49. Otherwise, continue to Learning Step 44.
____ 44. Study	Job Sheet #6--Align Angle Plate at Right Angle to Column, pages MM-183 through MM-185.
____ 45. Watch	Slide/tape presentation, "Align Angle Plate at Right Angle to Column" (MM-II-6).
____ 46. Do	Job Sheet #6--Align Angle Plate at Right Angle to Column.
____ 47. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11f, and proceed to Learning Step 49. Otherwise, repeat Learning Steps 44 through 46 and then continue to Learning Step 48.
____ 48. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11f, and continue to Learning Step 49. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11f, and continue to Learning Step 49.
____ 49. Refer	To Learning Step 11g. If this task has been initialed by your instructor, proceed to Learning Step 55. Otherwise, continue to Learning Step 50.
____ 50. Study	Job Sheet #7--Mill Square a Workpiece Mounted in Vise, pages MM-187 through 190.

_____ 51. Watch	Slide/tape presentation, "Mill Square a Workpiece Mounted in Vise" (MM-II-7).
_____ 52. Do	Job Sheet #7--Mill Square a Workpiece Mounted in Vise.
_____ 53. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11g, and proceed to Learning Step 55. Otherwise, repeat Learning Steps 50 through 52 and continue to Learning Step 54.
_____ 54. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11g, and continue to Learning Step 55. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11g, and continue to Learning Step 55.
_____ 55. Refer	To Learning Step 11h. If this task has been initialed by your instructor, proceed to Learning Step 61. Otherwise, continue to Learning Step 56.
_____ 56. Study	Job Sheet #8--Perform Face Milling Operation Using Style "C" Arbor, pages MM-191 through MM-193.
_____ 57. Watch	Slide/tape presentation, "Perform Face Milling Operation Using Style "C" Arbor" (MM-II-8).
_____ 58. Do	Job Sheet #8--Perform Face Milling Operation Using Style "C" Arbor.

_____ 59. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11h, and proceed to Learning Step 61. Otherwise, repeat Learning Steps 56 through 58 and then continue to Learning Step 60.
_____ 60. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11h, and continue to Learning Step 61. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11h, and continue to Learning Step 61.
_____ 61. Refer	To Learning Step 11i. If this task has been initialed by your instructor, proceed to Learning Step 67. Otherwise, continue to Learning Step 62.
_____ 62. Study	Job Sheet #9--Mill a Keyway with Staggered Tooth Mill Cutter, pages MM-195 through MM-199.
_____ 63. Watch	Slide/tape presentation, "Mill a Keyway with Staggered-Tooth Mill Cutter" (MM-II-9).
_____ 64. Do	Job Sheet #9--Mill a Keyway with Staggered-Tooth Mill Cutter.
_____65. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11c, and proceed to Learning Step 67. Otherwise, repeat Learning Steps 62 through 64 and then continue to Learning Step 66.

_____ 66. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11i, and continue to Learning Step 67. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11i, and continue to Learning Step 67.
_____ 67. Refer	To Learning Step 11j. If this task has been initialed by your instructor, proceed to Learning Step 73. Otherwise, continue to Learning Step 68.
_____ 68. Study	Job Sheet #10--Perform a Straddle Milling Operation, pages MM-201 through MM-203.
_____ 69. Watch	Slide/tape presentation, "Perform a Straddle Milling Operation" (MM-II-10).
_____ 70. Do	Job Sheet #10--Perform a Straddle Milling Operation.
_____ 71. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11j, and proceed to Learning Step 73. Otherwise, repeat Learning Steps 68 through 70 and then continue to Learning Step 72.
_____ 72. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11j, and continue to Learning Step 73. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11j, and continue to Learning Step 73.

_____	73. Refer	To Learning Step 11k. If this task has been initialed by your instructor, proceed to Learning Step 79. Otherwise, continue to Learning Step 74.
_____	74. Study	Job Sheet #11--Mill an Angle with Single Angle Mill Cutter, pages MM-205 through MM-207.
_____	75. Watch	Slide/tape presentation,"Mill an Angle with Single-Angle Mill Cutter" (MM-II-11).
_____	76. Do	Job Sheet #11--Mill an Angle with Single Angle Mill Cutter.
_____	77. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11k, and proceed to Learning Step 79. Otherwise, repeat Learning Steps 74 through 76 and then continue to Learning Step 78.
_____	78. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11k, and continue to Step 79. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11k, and continue to Learning Step 79.
_____	79. Refer	To Learning Step 11L. If this task has been initialed by your instructor, proceed to Learning Step 85. Otherwise, continue to Learning Step 80.
_____	80. Study	Job Sheet #12--Mill to Blueprint Specifications Using Machine Controls, pages MM-209 through MM-215.

____	81. Watch	Slide/tape presentation, "Mill to Blueprint Specifications Using Machine Controls" (MM-II-12).
____	82. Do	Job Sheet #12--Mill to Blueprint Specifications Using Machine Controls.
____	83. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11L, and proceed to Learning Step 85. Otherwise, repeat Learning Steps 80 through 82 and then continue to Learning Step 84.
____	84. Stop.	Have your instructor evaluate your work. If you achieve a Skilled or Moderately Skilled rating, have your instructor initial Learning Step 11L, and continue to Learning Step 85. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, have your instructor initial Learning Step 11L, and continue to Learning Step 85.
____	85. Refer	To Learning Step 11. If all tasks have been initialed by your instructor, continue to Learning Step 86. Otherwise, refer to the Learning Step indicated in parentheses after the unsigned task.
____	86. Review	Information Sheet pages MM-149 through 154, Assignment Sheet, and LAP Assignment Sheets.
____	87. Take	Horizontal Milling Machines Test (see your instructor). If your score is 85 percent or above, continue to the next assigned Learning Activity Packet. Otherwise, ask your instructor about additional study requirements and possible retesting.

MILLING MACHINES
UNIT II--HORIZONTAL MILLING MACHINES

PRETEST

NAME _____ SCORE _____

DIRECTIONS: The purpose of this pretest is to determine how much you already know about horizontal milling machines. Your performance on this pretest will not be used to determine your grade in the course. Instead, it will guide your instructor in designing this course to meet your needs. If you are unsure of and answer to a question, do not guess. Guessing may keep you from receiving needed instruction.

1. Match terms and definitions associated with horizontal milling machines. Write the correct numbers in the blanks. Terms and definitions are continued on the next page.

_____ a.	Thin pieces of metal, usually steel, used to level or align workpiece or work-holding device when setting up	1. Indexing
_____ b.	Method of describing the diameter, width, and hole or shank size of a mill cutter	2. Shims
_____ c.	To prepare the machine prior to performing a particular operation	3. Seat
_____ d.	To align at 90-degree angle	4. Square
_____ e.	Process of dividing a circular or straight part into exact divisions	5. Fly-cutter
_____ f.	Special holder that may hold from one to six tool blanks	6. Set up
_____ g.	To set a workpiece solidly in work-holding device	7. Cutter size
_____ h.	To align by using a dial indicator	8. Align
_____ i.	To set correct relative position between cutter axis and workpiece	9. Axis
_____ j.	T-shaped groove machined into tables and attachments to allow the use of bolts and nuts when mounting work-holding devices or accessories	10. T-slot
		11. Indicate
		12. Spindle rotation
		13. Parallels
		14. Helix

_____ k. Center line of cutter rotation

_____ l. Curved path that advances at a uniform rate along a cylinder

_____ m. Direction spindle revolves as viewed from front of machine; referred to as right-hand (clockwise) or left-hand (counterclockwise)

_____ n. Accurately machined bars with adjacent sides square to each other and opposite sides parallel; made in matched sets; used to support workpiece when machining or setting up

2. Match types of horizontal milling operations to their correct descriptions. Write the correct numbers in the blanks.

_____ a. Milling a flat surface using the peripheral teeth of an arbor-mounted mill cutter

_____ b. Producing or enlarging a hole with a bit or boring tool mounted in spindle of horizontal milling machine

_____ c. Machining a surface that is parallel to face of cutter

_____ d. Milling a recess with an arbor-mounted or spindle-mounted cutter

_____ e. Using a number of cutters to cut several surfaces in one operation

_____ f. Machining the end of workpiece with a cutter having side-cutting teeth

_____ g. Using two arbor-mounted cutters to make two parallel cuts in one operation

_____ h. Dividing a workpiece into equal spaces, angles, or divisions about an axis, using a dividing head to rotate workpiece

1. Straddle milling
2. Face milling
3. Gang milling
4. Side milling
5. Slab milling (plain milling)
6. Slotting (grooving)
7. Indexing
8. Drilling (boring)

3. Stop. Have your instructor evaluate your pretest and mark the area(s) below requiring additional study.

   Refer to the Information Sheet, Section(s)

   _____ I _____ II

   You came here from Learning Step 2. If neither of the above sections is checked, proceed to Learning Step 11. Otherwise, study the required section and then continue to Learning Step 3.

MILLING MACHINES
UNIT II--HORIZONTAL MILLING MACHINES

LAP ASSIGNMENT SHEET #1

NAME _____ SCORE _____

1. Identify the correct terms defined below. Write the correct terms in the blanks.

_____a. Thin pieces of metal, usually steel, used to level or align workpiece or work-holding device when setting up

_____b. Method of describing the diameter, width, and hole or shank size of a mill cutter

_____c. To prepare the machine prior to performing a particular operation

_____d. To align at 90-degree angle

_____e. Process of dividing a circular or straight part into exact divisions

_____f. Special holder that may hold from one to six tool blanks

_____g. To set a workpiece solidly in work-holding device

_____h. To align by using a dial indicator

_____i. To set correct relative position between cutter axis and workpiece

_____j. T-shaped groove machined into tables and attachments to allow the use of bolts and nuts when mounting work-holding devices or accessories

_____k. Center line of cutter rotation

_____l. Curved path that advances at a uniform rate along a cylinder

_____m. Direction spindle revolves as viewed from front of machine; referred to as right-hand (clockwise) or left-hand (counterclockwise)

_____n. Accurately machined bars with adjacent sides square to each other and opposite sides parallel; made in matched sets; used to support workpiece when machining or setting up

2. Stop. Have your instructor evaluate your LAP Assignment Sheet and mark the appropriate blank below.

_____ Refer to Information Sheet, Section I for additional study and then go to Learning Step 6.

_____ Proceed to Learning Step 7.

MILLING MACHINES
UNIT II--HORIZONTAL MILLING MACHINES

LAP ASSIGNMENT SHEET #2

NAME _____ SCORE _____

1. Fill in the missing words to complete the following terms and definitions associated with horizontal milling machines.

   a. SPINDLE ROTATION--Direction spindle revolves as viewed from front of machine; referred to as _____

   b. INDICATE--To _____ by using a dial indicator

   c. SQUARE--To _____ at a 90-degree angle

   d. CUTTER SIZE--Method of describing the _____, width, and hole or shank size of a mill cutter

   e. T-slot--T-shaped _____ machined into tables and attachments to allow the use of bolts and nuts when mounting work-holding devices or accessories

   f. SEAT--To _____ a workpiece solidly in work-holding device

   g. AXIS--_____ _____ of cutter rotation

   h. PARALLELS--Accurately machined bars with adjacent sides _____ to each other and opposite sides _____; made in matched sets; used to support workpiece when machining or setting up

   i. SET UP--To _____ the machine prior to performing a particular operation

   j. SHIMS--Thin pieces of metal, usually steel, used to _____ or _____ workpiece or work-holding device when setting up

k. FLY-CUTTER--Special _____ that may hold from one to six tool blanks

l. HELIX-- _____ _____ that advances at a uniform rate along a cylinder

m. ALIGN--To set correct relative position between _____ _____ and workpiece

n. INDEXING--Process of _____ a circular or straight part into exact divisions

2. Stop. Have your instructor evaluate your LAP Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 7. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 7.

MILLING MACHINES
UNIT II--HORIZONTAL MILLING MACHINES

LAP ASSIGNMENT SHEET #3

NAME _____ _____ SCORE _____

1. Complete the following descriptions of horizontal milling operations by by writing the correct words in the blanks.

   a. FACE MILLING--Machining a surface that is _____ to face of cutter

   b. SLAB MILLING (PLAIN MILLING)--Milling a flat surface using the _____ _____

   c. SLOTTING (GROOVING)--Milling a recess with an _____ _____

   d. SIDE MILLING--Machining the end of a workpiece with a _____ _____

   e. STRADDLE MILLING--Using two arbor-mounted cutters to make _____ _____

   f. GANG MILLING--Using a number of cutters to cut _____ _____

   g. DRILLING (BORING)--Producing or enlarging a hole with a _____ _____

   h. INDEXING--Dividing a workpiece into equal spaces, angles, or divisions about an axis, using a _____ _____

2. Match types of horizontal milling operations to key phrases in their descriptions. Write the correct numbers in the blanks.

_____ a.	A number of cutters	1. Slab milling
_____ b.	Surface parallel to face of cutter	2. Gang milling
_____ c.	Producing or enlarging a hole	3. Slotting
_____ d.	A recess with an arbor-mounted or spindle-mounted cutter	4. Drilling
_____ e.	Peripheral teeth	5. Side milling
_____ f.	Equal spaces or divisions	6. Indexing
_____ g.	Two parallel cuts in one operation	7. Straddle milling
_____ h.	Side-cutting teeth	8. Face milling

3. Stop. Have your instructor evaluate your LAP Assignment Sheet. If your instructor is satisfied with your progress, continue to Learning Step 11. If additional study is required, discuss a study program with your instructor. Once you have completed that program to your instructor's satisfaction, continue to Learning Step 11.

MILLING MACHINES
UNIT II--HORIZONTAL MILLING MACHINES

ANSWERS TO PRETEST

1.	a.	2	h.	11
	b.	7	i.	8
	c.	6	j.	10
	d.	4	k.	9
	e.	1	l.	14
	f.	5	m.	12
	g.	3	n.	13
2.	a.	5	e.	3
	b.	8	f.	4
	c.	2	g.	1
	d.	6	h.	7

MILLING MACHINES
UNIT II--HORIZONTAL MILLING MACHINES

ANSWERS TO LAP ASSIGNMENT SHEET #1

1. a. Shims
   b. Cutter size
   c. Set up
   d. Square
   e. Indexing
   f. Fly-cutter
   g. Seat
   h. Indicate
   i. Align
   j. T-slot
   k. Axis
   l. Helix
   m. Spindle rotation
   n. Parallels

MILLING MACHINES
UNIT II--HORIZONTAL MILLING MACHINES

ANSWERS TO LAP ASSIGNMENT SHEET #2

1. a. Right-hand, left-hand
   b. Align
   c. Align
   d. Diameter
   e. Groove
   f. Set
   g. Center line
   h. Square, parallel
   i. Prepare
   j. Level, align
   k. Holder
   l. Curved path
   m. Cutter axis
   n. Dividing

MILLING MACHINES
UNIT II--HORIZONTAL MILLING MACHINES

ANSWERS TO LAP ASSIGNMENT SHEET #3

1. a. Parallel
   b. Peripheral teeth of an arbor-mounted mill cutter
   c. Arbor-mounted or spindle-mounted cutter
   d. Cutter having side-cutting teeth
   e. Two parallel cuts in one operation
   f. Several surfaces in one operation
   g. Bit or boring tool mounted in spindle of horizontal milling machine
   h. Dividing head to rotate workpiece

2. a. 2
   b. 8
   c. 4
   d. 3
   e. 1
   f. 6
   g. 7
   h. 5